Chapter 3 - Watershed Inventory: Prioritized Pollutants, Sources & Causes

KAWKAWLIN RIVER INVENTORY

Methodology and Findings of the Watershed Inventory

INTRODUCTION

In an effort to narrow the area of focus on a large watershed such as the Kawkawlin, an attempt was made to utilize the Watershed Assessment of River Stability and Sediment Supply (WARSSS) procedure developed by Rosgen (2006). WARSSS was developed to quantify the effects of land uses on sediment relations and channel stability and it is intended that large watersheds can be assessed very quickly using this three-phase approach to identify the hillslope, hydrologic and channel processes responsible for negative impacts to the stream. The Reconnaissance Level Assessment (RLA) is the first phase and focuses primarily on using existing data to identify potential problem areas within the watershed that require more detailed field assessment. Specific to the Kawkawlin River watershed, it was believed that the RLA would provide the information necessary for prioritizing hydrologic unit classification (HUC) sub-watersheds and guiding the process of identifying critical and priority areas. However, upon further examination of the WARSSS procedure and of the Kawkawlin River watershed, it became apparent that the RLA would not yield useful results for this plan. As such, a methodology was developed that could quantify each sub-watershed based upon several criteria, several of which are common to WARSSS.

METHODS

Rosgen (2006) was reviewed and used as a template for the assessment; however, WARSSS was determined to be inappropriate for use in this watershed. Specifically, based upon the RLA criteria, all eight Kawkawlin sub-watersheds would advance to the second phase of the WARSSS assessment, and there is no way to quantify potential differences between sub-watersheds. Further, the Kawkawlin River watershed is so monotypic across most of its geographic scope in terms of soil types, slope, channel modification and land use that criteria in addition to those listed in WARSSS had to be considered to prioritize the sub-watersheds.

Step 1. Compile and Map Existing Data

- GIS data sources included: Baseflow channels for the Kawkawlin River and tributaries, SSURGO Soils, 1978 Land Use/Land Cover, 1992 Land Use/Land Cover, 1978 Aerial Photography, 2006 Aerial Photography.

- Michigan Department of Environmental Quality biological monitoring results from 1989, 1993, 1995, 2000 and 2005
- Bay, Midland and Gladwin County drain maps and records

Step 2. Review the Landscape History

- Using 1978 and 2001 LULC data and 1978 and 2006 aerial photography, an analysis of land use change was conducted. It was determined that very little change has occurred over the past few decades. Agricultural practices have dominated all areas that have been effectively drained. Much of the areas not being farmed are wetland.

Step 3. Rapid Watershed Review

- An overview of the watershed was conducted over the course of two days. The overview included driving the majority of the roads within the watershed and observing the Kawkawlin River and its tributaries from road crossings, land use and other notable features within the watershed and collecting biological samples at several sites. Results of this overview survey were analyzed and plotted on a GIS, including all road crossings with obvious water quality problems such as excessive algae or plant growth, sediment accumulation, bank erosion or livestock in the stream.

Step 4. Assess Hydrologic Processes

- Based upon analysis of land use data, field observation and historic personal accounts, the hydrology of the watershed has not changed significantly over the past several decades. Additionally, significant change is not expected in the near future.

Step 5. Identify Direct Impacts to Streambanks and Channels

- Nearly every channel within the watershed has been directly impacted to some extent. Most of the streams are maintained as agricultural drains. The main branch of the Kawkawlin is in a relatively natural state but direct impacts are associated with road crossings and armored banks near the outlet. Despite the extensive modifications throughout the watershed, erosion and other evidence of channel "recovery" is not widespread. Overall, the agricultural tributaries are very stable and covered with herbaceous vegetation. Eroded banks are locally prevalent in forested and grazed portions of the upper watershed.

Step 6. Summarize Activities that Potentially Affect Sediment Supply and Channel Stability

- An analysis of Steps 1-5 resulted in a list of considerations for the Kawkawlin River watershed, including:
    - Livestock in the stream
    - Modified channels for agriculture
    - Dense drainage network
    - Lack of stream buffers

- Extensive and widespread agricultural land use including tiled fields and deep tillage practices
- Limited, but locally significant streambank erosion

Step 7. Development and complete ranking matrix based upon criteria and information determined important during Steps 1-6.

- Criteria used to develop the matrix for each Kawkawlin sub-watershed included:
  - Percentage of agricultural land
  - Percentage of wetland
  - Percentage of channel without vegetative buffer
  - Drainage density (feet of stream per acre)
  - Obvious problems recorded during Step 3
  - Ecological score, including results of biological surveys, amount of quality riparian and upland habitat, wildlife travel corridor, etc.
- Each sub-watershed was given a score between one and eight for each criterion, depending on how it ranked compared to other sub-watersheds. Scores of each criterion were added for each subwatershed, giving each sub a total score out of a possible 56 points.

Step 8. Based upon prioritization in Step 7 and observation of obvious problems, areas, sub-watersheds or specific river reaches were selected for further assessment.

RESULTS

Results of the prioritization process are included in Table 1. Subwatershed 7 was ranked as the number one priority, followed by Subwatersheds 6, 3, 2, 5, 8, 4 and 1. The highest priority subwatersheds are located in the most intensively farmed portion of the Kawkawlin watershed and are impacted by overland sediment and nutrient pollution. The lowest ranking sub, number 1, is located in the northern portion of the Kawkawlin watershed, which contains much more wetland and forested land. The primary issue of concern in Sub 1 appears to be livestock access and streambank erosion.

Geomorphic Assessment

A thorough geomorphic assessment has not been completed at this time. Most of the tributaries and portions of the mainstream have been dredged or maintained over the last several decades. In large part, the tributaries consist of straight, deep, trapezoidal channels capable of containing relatively large storm flows.

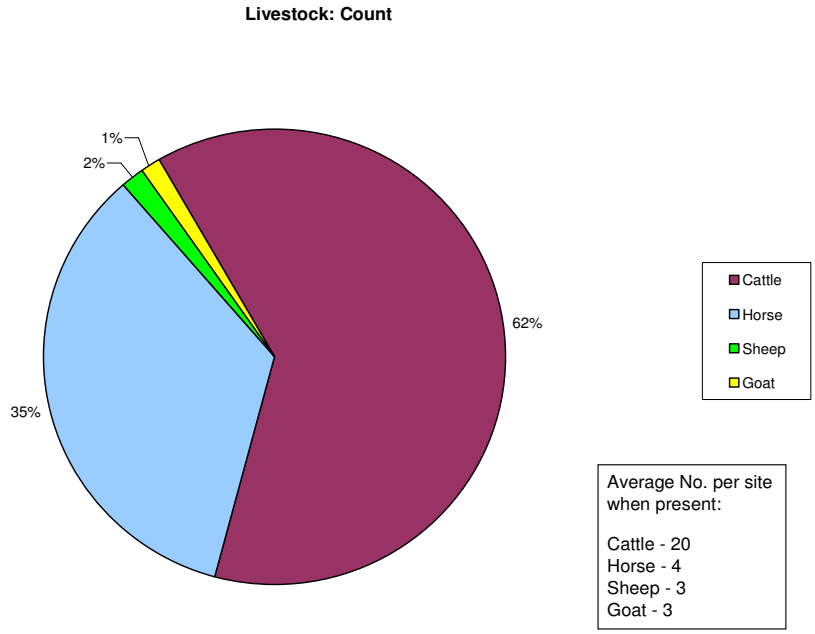
Natural sections of the main branches of the Kawkawlin, as well as the relatively undisturbed tributaries, would be considered to be C or E type channels if using the

Rosgen (1996) classification system. These channels are distinguished by their wide floodplains that are inundated during smaller storm events (1-5 year).

Inventories

Livestock Inventory

The entire watershed was assessed for domestic livestock on parcels, the survey was a "windshield" survey with the person not leaving the vehicle or entering onto private property. There were 78 of these surveys completed, in other words, 78 parcels identified with domestic animals observed on the parcels. Only two sites were observed where domestic animals had access to the river. Manure storage problems where nutrients and pathogens could reach the river were a problem on 9% of the sites encountered. The animals present in the largest number were cattle, followed by horses, sheep and goats. However the highest incidence of parcels with domestic animals present was related to horses with 74% of the parcels, followed by cattle on 26% of the parcels. Most of the feeding of these domestic animals was described as range style and were not concentrated feed lots. As far as visible evidence of nutrients reaching the water this was only evidenced in 1.3% of the surveys.



Agricultural Inventory

A windshield survey was performed over the prioritized subwatersheds, starting with subwatershed #7, then 6, 3, 2, and 5. Subwatersheds 8, 4, and 1 were not surveyed. Subwatershed 8 is urban, Subwatershed 1 is mainly forested and headwaters of very good quality and Subwatershed 4 was not prioritized as having significant water quality problems, therefore the five subwatersheds were concentrated upon. There were 698 surveys completed by staff from Saginaw Bay RC&D and Spicer Group. Again, staff participating in this survey did not leave the vehicles and did not enter parcels to determine the extent of erosion in ag drains well out in the middle of large farm parcels. The surveys bear out the fact that the watershed is generally very flat with little slope. Agricultural practices show that no-till and minimum tillage are used about 50% of the time, with no till around 6%. The crop residue was predominantly corn and bean followed by wheat and sugar beet. These are the main crops grown in the watershed. A predominate amount of farmers were into crop rotation 92%, and a small percentage 4% did a cover crop. It was noted there was not much evidence of waste nutrients being applied to fields, only about 0.5% of the surveys, and of that percentage, there were 5 incidences where nutrients / pathogens could reach the drains and the river.

Evidence of erosion was noted 22% of the time, mostly in the form of rills or gullies to ag drains or roadside ditches. The sediment would then be subject to deposition in a county drain, tributary or the river. However, if the ditch or private ag drain was vegetated it appears to deposit less sediment at its outlet. Supporting the practice of keeping all drainage ditches or manmade surface conveyance systems vegetated to the maximum extent practicable. Erosion was not observed in 62% of the cases, but again this must be tempered with the fact this was a “windshield” survey and the investigators did not leave their vehicles and enter property. Temporary V-ditches were noted in 7.6% of the fields surveyed. The potential cause of streambank/ditch bank erosion was determined to be from the forces of surface flow in 92% of the cases and tile outlets were listed as a source of erosion in 6% of the cases.

Use of vegetated buffer strips was not as high as one would hope for, they were reported only about 8% of the time. They had an average width of 25 feet and appeared to be planted and well established with vegetation over 92% of the time.

Water quality in the portions of county drains visible was commented upon and in 73% of the cases the water was clear and was turbid in 5.6% of the time. The remaining 21.4% the drain was not visible and therefore no answer was applicable. No oily sheens or greenish colored water was noted during this survey.

Wind erosion was also a concern, 35% of the fields had a tree line. There was also ground cover of vegetation or crop residue to slow down wind erosion but the potential for wind erosion was felt to be high in 58% of the fields surveyed.

The complete survey by subwatershed is available in Appendix XX of this document.

On site Treatment Systems Inventory

The tasks completed in this inventory were the assessment of bacterial contamination and potential causes. Then investigate by data coordination the following information:

- Current On site disposal systems (OSDS)
- Bacterial testing
- Land use, and
- Other data as developed by other work groups

This data was then integrated into GIS maps to determine of find areas or parcels that were "at risk" or showing signs of failure and possibly contributing to contamination of the river.

The Bay County Health Department looked for information on 1,068 parcels, not including the 790 parcels that are directly adjacent to the main branch of the Kawkawlin River. Of the 1,068 parcels, 191 were not listed as being connected to municipal sewer and no existing OSDS records. 798 were connected to municipal sanitary sewage systems. 177 parcels had OSDS records associated with them, of those records it was determined the median age of OSD systems was 36 years. There is substantial follow up information and details that must still be collected by the Bay County Health Department, but, the work accomplished during this inventory and the maps created provide the framework for significant future work at eliminating sources of nutrients and pathogens to the Kawkawlin River. Data collected and the map produced is available in Appendix XX.

Wetland Inventory

The DNRE provided a comprehensive study of the wetlands within the Kawkawlin Watershed and ultimately summarized each of the eight sub-watersheds. The wetland boundaries were determined fro Aerial Imagery which was last updated in 2005. The 2005 National Wetland Inventory (NWI) data was used in this analysis to prepare the report on Status and Trends. Per the DNRE this is the best data source currently available. It must be realized that this is aerial data and is subject to interpretation of the conditions present, there may be errors in the interpretation of the data and it may not reflect current conditions on the ground as five years have passed since these aerial photographs were taken.

The DNRE – Resource Division has a begun a joint project with Ducks Unlimited to update the 1978 NWI using 1998 and 2005 aerial imagery. This project is ongoing and the data set developed will be used for all future Wetland Status and Trends analysis. The staff of the DNRE have developed a landscape level evaluation of the Kawkawlin Watershed based on the data available and have provided their analysis on a CD for use by municipal and township planners / planning commissions, local governing officials, conservancies, environmental groups, organized property owners associations, engineers, regulatory agencies and others to assist with planning and land use efforts in the Kawkawlin Watershed.

Sub-Watershed	1	2	3	4	5	6	7	8
Area of Presettlement Wetlands (acres)	16,336	16,944	1,394	5,452	10,091	8,636	6,933	5,669
Area of 2005 Wetlands (acres)	11,790	6,225	22.7	1,158	2,087	1,060	472	397
Presettlement Avg size of Wetlands (acres)	31	41	63	48	43	62	105	69
2005 Avg size of Wetlands (acres)	7.4	5.8	5.6	3.5	3.2	2.44	4	6.5
% of Original Wetland remaining	72%	36%	1%	21%	20%	12%	6%	7%
% Loss of wetland resource	28%	64%	99%	79%	80%	88%	94%	93%

Road/Stream Crossing Survey:

The Saginaw Bay RC&D completed a detailed road / stream crossing in 2000 for the Kawkawlin River and other regional streams. This report was very comprehensive and it should be used for determination of future tasks for the watershed in general. A major road crossing was completed on the Main, South and North Branches of the Kawkawlin using information from the Bay County Road Commission and Flow Rates obtained from the DNRE. The water way areas were looked at and the crossings were visited to determine if there was much erosion at these specific sites. The crossings were determined to be adequate and not the source of any significant erosion based on channel geometry and hydraulics at those points. However, there was evidence of erosion that may have been caused by winter ice conditions at these points.

Ecological Assessment

Ecological assessments included a survey of aquatic biological communities at six sites; aquatic and riparian habitat assessment; and general upland habitat assessments were performed. Assessment of the physical habitat and biological community of the

Kawkawlin River and its tributaries was completed to characterize the quality of the watercourses and to provide information necessary for making recommendations for improvements. In addition to collecting physical and biological data, previous studies performed by state agencies and other were reviewed and their findings evaluated.

The aquatic biological community was rated at six sites (exhibit XX). The assessment was conducted November 14, 2008 using protocols set forth in the Great Lakes Environmental Assessment Section, Procedure No. 51 (P51) (MDEQ 1997 and MDEQ 2002). P51 is a rapid assessment technique that is used by the DNRE to rate streams based upon their physical habitat and aquatic community. It should be noted that these assessments were conducted outside of the recommended seasonal sampling period, so caution must be used when comparing results of this study.

Sites were selected based upon preliminary field observation and review of existing data and previous sampling sites. An effort was made to fill data gaps that had been left by previous studies.

The abundance and diversity of aquatic macro invertebrates are commonly used as indicators of the overall quality of a stream. As such, assessment of the biological communities within the watershed was completed to characterize the quality of each watercourse, and to provide information necessary for making recommendations for improvements.

Dip nets with 1 mm mesh were used to sample aquatic macro invertebrates. Sampling was conducted in and upstream direction and each station was sampled until no new taxa were found (approximately 20 minutes for each station). All available habitats were sampled, including fast and slow moving water areas, had and soft substrates, vegetated areas, woody material and undercut banks. Kick sampling was used in most areas, except in slower moving water, where dip netting methods were used. Large stones and logs were sampled by hand picking. All organisms collected were identified, counted and recorded.

Relative to macro invertebrates, P51 uses a set of nine metrics to score the community based upon comparison to an excellent site within the same ecoregion. The P51 Microsoft EXCEL spreadsheet was used to calculate the following nine metrics for each station, to provide a qualitative rating of the macro invertebrate community (taxa is plural for taxon, which refers to a taxonomic category, such as family, genus or species):

- Total number of taxa
- Total number of mayfly taxa
- Total number of caddisfly taxa
- Total number of stonefly taxa
- Percent mayfly composition
- Percent caddisfly composition
- Percent stonefly composition
- Percent distribution of dominant taxon
- Percent isopods, snails, and leeches

- Percent surface dependant

The process results in a score based upon a scale of -9 to 9; -9 to -5 is rated poor; -4 to 4 is rated as acceptable; and anything greater than 4 is rated as excellent. Generally, flowing waters which harbor a high diversity of macro invertebrates, specifically different types of mayfly, caddisfly, and stonefly are of higher quality than those waters that have few taxa. Water bodies with low diversity often have very high numbers of individuals due to their ability to thrive in degraded water with little competition or predation.

Relative to the physical habitat, P51 was used to assess the six biological stations, along with 21 general sites within the watershed (Exhibit XX; Table XX). P51 considers such factors as the amount of woody debris and rock that organisms can hide amongst, the stability of the stream banks, the amount of vegetation growing along the stream margins, the degree of impact to adjacent lands. These "metrics" are scored on an individual basis and then compiled, resulting in a final score of up to 200 points. Sites scoring less than 56 are considered to be "poor"; those scoring between 56 and 104 are "marginal"; between 105 and 154 points is "good"; and sites scoring over 154 are "excellent".

Station 1: Hoppler Creek @ Auburn Road

At the sample site, the drain is linear with evidence of past channelization. Habitat surveys resulted in a score of 113/200, with an adjective rating of good (slightly impaired). The streambanks are extremely stable and well vegetated with herbaceous vegetation, shrubs and some trees. The riparian area is farmed close to the edge of the channel on the left bank, while the riparian area on the right bank contains a home with relatively natural and undisturbed buffer. Overhanging vegetation and small woody debris provide the only epifaunal cover; the dominant substrate is hard sand and the water is uniformly shallow in depth with exception of a pool downstream of the culvert.

The macro invertebrate community rating was rated as poor (-5). Seventeen taxa were collected, but the sample was heavily dominated by isopods. No mayflies or caddisflies were collected, but four individual stoneflies from the *Capniidae* family were collected. *Capniidae* are known to be intolerant of degraded conditions and were and unexpected find at this station, given the lack of quality habitat and degree of channel impact.

Station 2: South Branch Kawkawlin @ Garfield

Habitat at this station scored 125/200 (good, slightly impaired). Streambanks are very stable and contain dense growth of herbaceous vegetation with scattered trees and shrubs. A narrow, relatively deep low-flow channel exists within the confines of the originally excavated drain banks. The riparian area on the right bank consists of fallow farm field and that on the left bank contains a road with a mowed right of way.

High numbers of insects were collected but diversity was very low, with only nine taxa in the sample. The station scored -6, with an adjective rating of poor. Nearly 89% of the

sample consisted of amphipods, snails and chironomids. Mayflies, caddisflies and stoneflies were absent fro the collection.

Station 3: Herner Drain @ Jefferson Road

This station had the lowest habitat score of the six sites, scoring only 81/200 (marginal, moderately impaired). While it is the most natural of the channels in terms of morphology, it is heavily impacted by livestock grazing. Banks are trampled with locally severe erosion and riparian vegetation is grazed to the ground level on both sides of the stream, with exception of some mature trees. Substrate is poor and epifaunal substrate is noticeably lacking.

The macro invertebrate score of -6 is indicative of the poor habitat. Only seven taxa were collected and total number of organisms was quite low. Surface dependent Notonectids mad up about 83% of the sample. Two of the more tolerant families of caddisfly (*Hydropsychidae* and *Phryganeidae*) were present at this location.

Several trout were observed in the Herner Drain upstream of this site in May 2009. Trout are known to be intolerant of degraded water conditions. It is unknown if trout are year round residents of the drain, or if the individuals observed were seeking a seasonal refuge, food source, etc.

Station 4: Watson Drain @ Rhodes Road

Another relatively natural meandering channel, the physical habitat of the Watson Drain scored 129/200 (good, slightly impaired). The riparian area is well vegetated and streambanks are quite stable. A good tree canopy shades the stream. Though the bottom is quite sandy, epifaunal substrate exists in the form of leaf packs, woody debris and overhanging vegetation.

This station received the highest macro invertebrate score -2 of all those sampled and rates as acceptable. Five families of caddisfly and one family of both stoneflies and mayflies were found, including several that are intolerant of degraded conditions.

Station 5: South Branch Kawkawlin River at Chip Road

The river is wide and deep at this location and probably not suitable for P51 assessment, even during normal flow. However, since this site is representative of a dominant condition of the South Branch in this region, data was collected and the results indicate that habitat is good (slightly impaired) with a score of 123/200. Riparian areas consist of well vegetated wetland and floodplain, with exception of scattered residences. Streambanks are fairly stable.

The macro invertebrate community rated a poor (-8), this score may be related to ineffective sampling during the high water level encountered on the sampling date.

Station 6; North Branch Kawkawlin River at Jefferson Road

This river station has the highest quality of habitat (148/200) amongst all of the stations sampled. All individual metrics scored within the good to excellent categories with exception of pool variability and sinuosity.

Despite the high quality habitat, this station received the lowest macro invertebrate score (-9) of all stations. Only eight taxa were collected and all organisms are tolerant of degraded conditions. It is quite possible this site, along with the upper reaches of many other tributaries lack water during dry weather periods. This may be the cause for low macro invertebrate scores. Water levels in the reach were high during November 2008 assessments and these tributaries should be assessed during low flow periods.

General Aquatic and Riparian Habitat Assessments

Rapid assessment of aquatic and riparian habitat was undertaken to generally describe the habitat condition of the stream corridors. These assessments used P51 to document existing habitat in each of the 21 selected tributaries. While many of the tributaries differ in physical condition along their length, areas representing the dominant condition were selected for assessment. Table XX (4 in report) summarizes the results of this assessment.

Nearly all of the channels were determined to be moderately impaired. Results show that many of the lowest scoring tributaries are located in the highest priority subwatersheds. Also, an overwhelming problem found in nearly all of the channels in the middle and southern portions of the watershed is the lack of riparian buffer, primarily due to the encroachment of agricultural practices. Sediment pollution was also determined to be impacting a majority of the sites throughout the watershed.

Water Quality Monitoring

DNRE

The DNRE has conducted numerous water quality monitoring studies in the Kawkawlin Watershed. The monitoring is detailed in the section of this report devoted to "Studies", these monitoring efforts include biological surveys, pathogen monitoring, nutrient monitoring and fish surveys.

Kawkawlin River Watershed Property Owners Association

This group of active stewards of the Kawkawlin River has performed their own monitoring studies related to water quality on the river. Their reports are available in the section referred to above. This group will be very active in the rehabilitation of the river and there organization should be used as much as it can, for they are a "hands on" group that wants to be involved. They can be a valuable resource for the river as a stakeholder group, political activist group and as a proponent for rehabilitation of the river. This

group has done sampling and put together testing results from a E. coli sampling they have been doing since 1998 and posting on their web site. The following is their website:

http://kawkawlinriver.net/

Spicer Group Spot Sampling

Spicer Group performed spot sampling when in the Kawkawlin Watershed. This sampling was done on an intermittent basis with a HACH QUANTA unit that would test multiple parameters at a site, specifically; Temperature, Specific Conductivity, Dissolved Oxygen, pH, TDS, and Turbidity. The only poor results encountered during the sampling was on the North Branch of the Kawkawlin River for low Dissolved Oxygen at the following two locations. At the Mackinaw Road crossing on August 14, 2009 and September 2, 2009 the DO was 0.58 mg/L and 2.75 mg/L, respectively. At the Fraser Road crossing of the North Branch on the same dates, the following DO was recorded, 2.13 mg/L and 3.36 mg/L respectively.

Flow Rates

The following table contains flow rates for selected crossings throughout the Kawkawlin Watershed. The source is the hydrology section of the DNRE. Flow rates are for the 10%, 4%, 2% and 1% recurrence intervals.

Location	Drainage Area (Sq. mi.)	Peak Flows			
		10% cfs	4% cfs	2% cfs	1% cfs
Kawkawlin River at Eight Mile Road, Section 12, T14N, R3E, Williams Township	25.2	1100	1400	1600	1800
North Branch Kawkawlin River at Erickson Road, Section 7, T16N, R3E, Garfield Township	25.9	850	1100	1200	1400
North Branch Kawkawlin River at Townline Road, Section35, T15N, R4E, Kawkawlin Township	105	1610	1900	2080	2340
North Branch Kawkawlin River at Eight Mile Road, Section 13, T14N, R4E, Beaver Township	84.2	1400	1600	1800	2000
Kawkawlin River at Mackinaw Road, Section 16, T14N, R4E, Monitor Township	91.4	1800	2200	2600	2900
Kawkawlin River at Euclid Road, Section 6, T14N, R5E, Bangor Township	220	3720	4600	5180	5870
Kawkawlin River at Townline Road, Section 36, T15N, R3E, Beaver Township	43.9	1400	1700	2000	2300
Kawkawlin River at I-75, Section 3, T14N, R4E, Monitor Township	101	1800	2200	2600	2900
North Branch Kawkawlin River at Garfield Road, Section 3, T15N, R3E, Beaver Township	75.5	1200	1400	1600	1800
Kawkawlin River at Ehlers Road, Section 13, T16N, R2E, Mills Township	22.9	470	600	700	800
North Branch Kawkawlin River at I-75, Section 17, T15N, R4E, Kawkawlin Township	87.7	1400	1700	1800	2100
North Branch Kawkawlin River at Flajole Road, Section 31, T16N, R3E,Garfield Township	67.5	1100	1300	1400	1600

Pollutants, Sources, & Causes

Point Sources

The NPDES discharge inventory lists the watersheds townships involved in Phase II stormwater discharge, which are: Charter Township of Bangor, Kawkawlin Township, and Monitor Township. Additionally, the White Birch Village Mobile Home Park has a permit to discharge storm water to a county drain. There are a total of 21 industrial permits in the watershed, of these only two have monitoring requirements. The Huron and Eastern Railway Company which discharges to the Kawkawlin River and Dow Corning Corporation which discharges to Hoppler Creek have general permits to discharge to these surface waters and the permits can be viewed on the DNRE websites as necessary. A complete list of the 26 permit holders and their permit numbers is located in Appendix XX.

Non-Point Source Pollution

Soil Erosion and Sedimentation in Kawkawlin River

Road Crossings

Road crossings are a source of storm water contaminated with nutrients and pathogens from sediment and road kill, to sources of petroleum based products such as oil, gasoline, diesel fuel, coolants and road salt. These crossings are also a source of soil erosion problems due to poorly designed road crossings, failing headwalls, limited maintenance programs, changes in hydrology affecting local hydraulics at the crossing. Crossings are also used in the very rural areas as a disposal or dumping area for household trash and construction / demolition materials.

Changes in Hydrology (Flow)

Excessive peak flows can be a result of changing land uses in a given area. For example, a fallow field may go back into agricultural production with row crops, which will increase runoff potential. Therefore, increased drainage in specific areas can result in increased flows to drains feeding to the Kawkawlin. This flow will be characterized by higher peak flows and in some cases sustained peak flows. The higher peak flows will increase the steam power or the ability for flowing water to perform "work" this work is essentially erosion, the ability to carrier a sediment load. This stream power results in the ability for excessive bank erosion, increased bed scouring and re-suspension of sediments previously deposited. Additionally, there can be habitat destruction along the channel. This rogue hydrology can also affect the diversity of aquatic fish and bottom dwellers and decrease the diversity if the situation is not corrected.

Stormwater Runoff and Drainage from Agricultural Lands in the Watershed

As in most watersheds there are a group of concerned, educated farmers who take their responsibility as stewards of the land very seriously and participate in promoting best management practices. However, there is a section of the rural population that still needs to be educated on agricultural best management practices for their industry or in some cases for their "hobby" farms. Examples of domestic livestock in a position to have their wastes runoff into drains, tributaries or the river directly were observed during surveys. Livestock that grazed the floodplain in very close proximity to the river were also observed. There were only a couple of incidents were livestock were impacting waterways by direct access to the watercourse to create problems associated with erosion and stream bed disturbances.

The windshield survey and field work supported the lack of sustainable common agricultural practices. The following situations were observed that contribute to soil erosion and sedimentation in the watershed:

- Use of "V"-ditches for surface drainage without a BMP in place to prevent sediment movement from the site.
- Farming to the edge of the established county drains without regard to drainage patterns.
- Care of field tile outlets to prevent bank erosion.
- Plowing to direct runoff directly to the county drains.
- Unnecessary exposure of soil to the elements without leaving a cover crop or crop residue to prevent erosion or sediment transport.

Construction Activities

Construction results in exposed and compacted soils from heavy equipment increasing the potential for stormwater runoff. The removal of the natural vegetated cover on a parcel sharply increases the amount of sediment transported from the site into local waterways. During the survey process a small number of sites were observed, more control needs to be exercised at construction sites to assure that BMPs are well maintained and properly placed. The program should be looked at to assure there is proper funding for enforcement of existing county programs to prevent sedimentation in local drainage systems and ultimately the river. If necessary, the counties should look at the SESC enforcement ordinance in place in Saginaw County. The county enforcement agency (CEA) has the ability to write a ticket for a civil infraction with a monetary penalty for soil erosion and sediment control problems that are ongoing.

Studies

The following is a summary of a sequence of studies completed by the former MDNR from 1990 to 2007.

Michigan Department of Natural Resources, 1990:

Stations were sampled on the Kawkawlin River at Mackinaw, Eight Mile and Beaver Roads (Exhibit XX). This study found that, while conditions did improve since their previous assessment in 1987, the quality of the Kawkawlin River remained poor to fair

based upon biological communities, water sampling and habitat observations. High levels of turbidity and suspended solids were evident at all sampling locations and nonpoint sources were identified as a major contributor to impairment. Nitrogen, phosphorus, oil and grease, chloride and sulfate were also identified as pollutants.

Michigan Department of Natural Resources, 1994:

The Kawkawlin River was sampled at Eight Mile and Beaver Roads as part of this study. Results were similar to those found in 1990 (Exhibit XX). Both macro invertebrate and habitat were rated as fair at both stations. Total phosphorus was elevated and reached levels capable of causing nuisance growth of aquatic plants and algae, and these problems were observed in the stream. Phosphorus was believed to originate from intensely farmed portions of the watershed. Low levels of dissolved oxygen were identified as causing fish kills at Beaver Road.

Michigan Department of Natural Resources, 1996:

The South Branch of the Kawkawlin was sampled at Beaver and Mackinaw Roads, Culver Creek was sampled at Wolverine Road and the North Branch of the Kawkawlin was sampled at Chip Road (Exhibit XX). The South Branch sites had good fish communities and the presence of juvenile northern pike and walleye suggested that this river was being used by both species for reproduction. Fish communities in the North Branch were sparse, possibly due to low dissolved oxygen levels. Macro invertebrate communities were rated as fair at all stations except Culver Creek, which was rated as poor. Moderately to severely impaired habitat was determined to be the reason for the low scores at all stations. Contributors to the impaired habitat conditions were identified as livestock access to the stream and lack of vegetated buffer strips. Total phosphorus levels were excessive at all stations, as was the growth of nuisance plants and algae.

Michigan Department of Natural Resources, 2000:

This study included sampling of two stations, one on the North Branch of the Kawkawlin River at Beaver Road and the other at North Union Road on Culver Creek, the actual data was gathered on 9/19/2000 (Exhibit XX). The macro invertebrate community was found to be acceptable at Beaver Road and poor at North Union Road. Habitat was rated as fair on both streams. Nonpoint source issues were identified as lack of riparian buffer zones, substantial runoff of sediment and nutrients from agricultural land and highly variable flow regimes. Water chemistry sampling indicated that levels of ammonia and total phosphorus exceeded average values.

Michigan Department of Natural Resources, 2007:

The water chemistry of the Lower Kawkawlin River was sampled at Euclid Road and determined not to exceed Michigan Water Quality Standards (Exhibit XX). However, at the time of the survey, the river was flowing upstream due to a strong wind off of Saginaw Bay.

The macro invertebrate community of the North Branch at Eight Mile Road was determined to be poor (Exhibit XX). There was a lack of flow and high suspended load noted in the report. At Beaver Road, the macro invertebrate community was found to be minimally acceptable.

On the South Branch of the Kawkawlin River, very high suspended solids were measured at Wheeler Road and had the highest value of all Saginaw Bay tributaries sampled as part of this 2007 report. The macro invertebrate community was found to be poor. Habitat was found to be marginal with poor substrate and erosion scars were prevalent. Downstream of the mouth of Culver Creek, the macro invertebrate community was found to be acceptable and physical habitat was rated as good. The water was clean when compared with other sites on the Kawkawlin River.

Pollutants / Problems Prioritized from Stakeholders Meeting

The stakeholders meeting in January, 2010 involved obtaining input from those attending on what they felt were the primary pollutants and problems on the Kawkawlin River and in the Kawkawlin watershed. The following fifteen items were brought up and then ranked by those attending the meeting. The following list is in the order as ranked by the meeting attendees:

1. Pathogens (E.coli)
2. Sediments
3. Nutrients
4. Flooding
5. Excessive aquatic plant growth
6. Altered hydrology
7. Channel blockage
8. Low Dissolved Oxygen
9. Herbicides, pesticides
10. Brine, Petroleum products, deicers, metals,
11. Pipeline crossings
12. Garbage, other solids
13. Temperature
14. Airborne toxics
15. NPS electric current

Year	Location	Total P (mg/L) HT (hold time exceeded)	Kjeldahl N (mg/L)	Suspended Solids (mg/L)
1989	**S.B. Kawkawlin** Mackinaw Rd	**0.17**	**1.95**	**37**
1989	**S.B. Kawkawlin** Eight Mile Rd	**0.182**	**1.78**	**60**
1989	**S.B. Kawkawlin** Beaver Road	**0.065**	**1.02**	**42**
1993	**N.B. Kawkawlin** Eight Mile Rd	**0.139**	**1.26**	**13**
1993	**N.B. Kawkawlin** Beaver Road	**0.26**	**1.39**	**8**
2000	**N.B. Kawkawlin** Beaver Road	**0.105 HT**	**1.22 HT**	**8**
2000	**Culver Ck.** At N. Union Rd	**0.078 HT**	**0.90 HT**	**<4**
2000	**S.B. Kawkawlin** Frasier Road	**0.123 HT**	**1.08 HT**	**50**
2005	**N.B. Kawkawlin** Eight Mile Rd	**0.084**	**0.782**	**ND**
2005	**N.B. Kawkawlin** Beaver Road	**0.268**	**0.954**	**5**
2005	**S.B. Kawkawlin** Wheeler Rd	**0.131**	**1.19**	**ND**
2005	**Kawkawlin River** Euclid Road	**0.193**	**1.06**	**25**

Year	Location	Macro Invertebrate Rating	Fish Habitat Rating	Stream Habitat
1989	**S.B. Kawkawlin** Mackinaw Rd	**Medium**	**Fair**	**Not rated in this study**
1989	**S.B. Kawkawlin** Eight Mile Rd	**Medium**	**Fair**	**Not rated in this study**
1989	**S.B. Kawkawlin** Beaver Road	**Poor**	**Low**	**Not rated in this study**
1995	**S.B. Kawkawlin** Mackinaw Rd	**Fair (Moderately Impaired)**	**Good (Slightly Impaired)**	**Not rated in this study**
1995	**S.B. Kawkawlin** Beaver Road	**Fair (Moderately Impaired)**	**Good (Slightly Impaired)**	**Not rated in this study**
1995	**Culver Creek** Wolverine Rd	**Poor (Severely Impaired)**	**Not rated in this study**	**Not rated in this study**
1995	**N.B. Kawkawlin** Chip Road	**Fair (Moderately Impaired)**	**Not rated in this study**	**Not rated in this study**
2000	**N.B. Kawkawlin** Beaver Road	**(-2) Acceptable**	**Not rated in this study**	**Fair (moderately impaired)**
2000	**Culver Ck.** At N. Union Rd	**(-7) Poor**	**Not rated in this study**	**Poor (severely impaired)**
2005	**N.B. Kawkawlin** Eight Mile Rd	**(-6) Poor**	**Not rated in this study**	**Good (slightly impaired)**
2005	**N.B. Kawkawlin** Beaver Road	**(-3) Acceptable**	**Not rated in this study**	**Good (slightly impaired)**
2005	**S.B. Kawkawlin** Wheeler Rd	**(-6) Poor**	**Not rated in this study**	**Marginal (moderately impaired)**
2005	**Kawkawlin River** D/S Culver Ck	**(-1) Acceptable**	**Not rated in this study**	**Good (slightly impaired)**

Total Maximum Daily Load (TMDL) for Dissolved Oxygen

In August of 2007 the Water Bureau of the then MDEQ, now DNRE released a TMDL for the North Branch of the Kawkawlin River of Bay County. This was done in accordance of Section 303(d) of the federal Clean Water Act and the United States EPA's Water Quality Planning and Management regulations (Title 40 of the Code of Federal Regulations, Part 130) requiring states to develop TMDLs for water bodies that are not meeting Michigan's Water Quality Standards (WQS) pursuant to Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). The TMDL process establishes the allowable loadings of pollutants for a water body based on the relationship between pollution sources and in stream water quality conditions. TMDLs provide states a basis for determining the pollutant reductions necessary from both point and nonpoint sources (NPS) to restore and maintain the quality of the water resources. This TMDL was developed to identify the sources of dissolved oxygen (DO) standard nonattainment in the North Branch of the Kawkawlin River in Kawkawlin and to quantify reductions in these sources necessary for attainment of the standard. The North Branch of the Kawkawlin River is designated as a Warmwater stream with a DO standard of 5 mg/L as a minimum. The nonattainment area is described as being on the N. Branch of the Kawkawlin from the confluence of the Kawkawlin River in T14N-R4E, Section 2 defined as the Reach Start to the Reach End 13 miles upstream at Eight Mile Road in T15N-R4E, Section 18. This report goes on to state that the **impaired designated uses** for the N. Branch in this reach are as follows:

- Warmwater fish and other indigenous aquatic live and wildlife uses

The point sources related to this TMDL are listed in the section titled Pollutant Loadings in following pages within this chapter.

Other Potential Pollutant Sources

Invasive and Non Native Species

Competitive Non native and invasive species are a threat to native wildlife, plants and fish in the watershed. The introduction of invasive species is the result of shipping, recreational boating, and landscaping activities. If these species are not addressed in a decisive manner they can flourish in the natural areas and watercourses of the river system. For example, zebra mussels, round goby, and spiny water fleas can out reproductively out compete native species and eliminate food sources for mature fish and wildlife. These are just a few examples of species that can be easily transported by recreational boaters from one water body to another.

Invasive wetland plants such as purple loosestrife, canary grass and phragmites have become a predominant species along the Saginaw Bay Coastal region. The once beautiful multi-specie coastal wetlands are slowly becoming a mono-species wetland zone. The phragmites can grow in height from four to twelve feet for a plant and block views of the lakes and rivers and create access problems for the public. The phragmites has even been known to anecdotally hinder winter rescue operations along the coastal

areas of Saginaw Bay by preventing rescuers from seeing fishermen in distress and blocking access to the water by rescue vehicles and equipment.

- The spiny water flea (*Bythotrephes cederstroemi*), or "B.C.," is not an insect at all, but a tiny (less than half an inch long) crustacean with a long, sharp, barbed tail spine. A native of Great Britain and northern Europe east to the Caspian Sea, the animal was first found in Lake Huron in 1984--probably imported in the ballast water of a trans-oceanic freighter. Since then, populations have exploded and the animal can now be found throughout the Great Lakes and in some inland lakes.

No one is really sure what effect spiny water fleas will have on the ecosystems of the Great Lakes region. But resource managers are worried, because the animals may compete directly with young perch and other small fish for food, such as "Daphnia" zooplankton.

Spiny water fleas also reproduce rapidly. During warm summer conditions each female can produce up to 10 offspring every two weeks. As temperatures drop in the fall, eggs are produced that can lie dormant all winter.

High numbers would not pose a problem if spiny water fleas were heavily consumed by predators. But its sharp spine makes it extremely hard for small fish to eat, leaving only some large fish to feed on them. As a result, spiny water flea populations remain high while populations of plankton, which they eat, have declined.

Likely means of spread: Spiny water flea eggs and adults may wind up unseen in bilge water, bait buckets, and livewells. Also, fishing lines and downriggers will often be coated with both eggs and adults.

- Zebra mussels (*Dreissena polymorpha*) are small, fingernail-sized mussels native to the Caspian Sea region of Asia. They are believed to have been transported to the Great Lakes via ballast water from a transoceanic vessel. The ballast water, taken on in a freshwater European port was subsequently discharged into Lake St. Clair, near Detroit, where the mussel was discovered in 1988. Since that time, they have spread rapidly to all of the Great Lakes and waterways in many states, as well as Ontario and Quebec.

  Diving ducks and freshwater drum eat zebra mussels, but will not significantly control them.

  Likely means of spread: Microscopic larvae may be carried in livewells or bilgewater. Adults can attach to boats or boating equipment that is in the water

- The goby is a bottom-dwelling fish that has great potential for causing impacts on Great Lakes fisheries. Originally the round goby and the tubenose goby were introduced into the St. Claire River in 1990, probably via contaminated ballast water of transoceanic ships.

Round goby are thriving in the Great Lakes Basin because they are aggressive, voracious feeders which can forage in total darkness. The round goby takes over prime spawning sites traditionally used by native species, competing with native fish for habitat and changing the balance of the ecosystem. The round goby is already causing problems for other bottom-dwelling Great Lakes native fish like mottled sculpin, logperch and darters. Goby can also survive in degraded water conditions, and spawn more often and over a longer period than native fish. Unfortunately, they have shown a rapid range of expansion through the Great Lakes.

Many of the characteristics of the round goby invasion parallel that of the Eurasian ruffe which is also now in the Great Lakes eco system.

- Phragmites (*Phragmites australis*) Also known as Common Reed, is native to the United States, but the more invasive strains originated in Europe and are thought to have been introduced in the late 1800s through ship ballast. This tall plumed perennial wetland grass is found along roadside ditches, drains, and marsh areas of the Great Lakes. In the Saginaw Bay and Kawkawlin Watershed it has been forming colonies that cover expansive areas and chokes out beneficial vegetation such as cat tails and other native plants that provide cover, habitat and food for native wildlife and fish.

- Purple Loosestrife (*Lythrum salicaria*) is a wetland plant from Europe and Asia. It was introduced into the east coast of North America in the 1800s. First spreading along roads, canals and drainage ditches, then later distributed as an ornamental, this exotic plant is in 40 states and all Canadian border provinces.

  The plant can form dense, impenetrable stands that are unsuitable as cover, food or nesting sites for a wide range of native wetland animals, including ducks, geese, rails, bitterns, muskrats, frogs, toads and turtles. Many rare and endangered wetland plants and animals also are at risk.

  Purple loosestrife thrives on disturbed, moist soils, often invading after some type of construction activity. Eradicating an established stand is difficult because of an enormous number of seeds in the soil. One adult can disperse 2 million seeds annually. The plant is able to re-sprout from roots and broken stems that fall to the ground or into the water.

  A major reason for purple loosestrife's expansion is a lack of effective predators in North America. Several European insects that only attack purple loosestrife are being tested as a possible long-term biological control in North America.

Likely means of spread: Seeds escape from gardens and nurseries into wetlands, lakes and rivers. Once in aquatic systems, seeds are easily spread by moving water and wetland animals.

Source: www.great-lakes.net/envt/flora-fauna/invasive/

These are but a few of the invasive species that have created problems in the Saginaw Bay region and the Great Lakes in general. Other aquatic plants have become a problem along the Kawkawlin also such as Eurasian milfoil and Curley leafed Pondweed are also problems that must be addressed. With the phosphorus loading of the Kawkawlin River and with phosphorus as the limiting nutrient, aquatic vegetation in the lower reach of the Kawkawlin will be a significant problem. The main branch has a aquatic plant treatment program in place, however, limiting the nutrient sources would help divert funds from aquatic plant management to matching funds for other projects to implement in the watershed. For example; determining locations and targeting "hot spots" of phosphorus laden sediments for removal from the South and Main Branches of the river to remove the source of nutrients for aquatic vegetation.

Debris and Trash

The dumping of trash at remote crossings and along drain banks is common place in rural areas of the watershed and is a result of human activities. This activity is detrimental to wildlife and fish causing and increase in mortality, disease and reduced aesthetics of the watershed. Additionally this dumping of large quantities of trash can block waterways and increase the incidence of erosion by changing channel hydraulics. This anthropomorphic activity results in water quality degradation. It is important the residents understand their roles as stewards of the watershed otherwise there is a general lack of concern for the water resources of the region. A summary of sites can be found in Appendix XX.

Kawkawlin River Watershed Property Owners Association – White Paper

The Kawkawlin River Watershed Property Owners Association (KRWPOA) has issued a white paper to communicate its position with regards to this watershed management plan and what its members feel are major concerns. Their position paper is in Appendix XX of this document and will serve to support the findings and concerns of this plan. In summary their document would like the plan to consider the following issues:

- Sedimentation abatement to address many issues.
- Resolution of the E.coli issue from all perspectives.
- Habitat restoration for the fisheries, waterfowl, and flood control.
- Flood control through sedimentation abatement and wetland restoration.
- Insure the "Sustainability" of the restoration through the use of sediment traps, filter strips, and other methods.
- Provide safe access for boating, fishing, and other recreation.

The KRWPOA has demonstrated that public access and water quality is an important component of their mission.

Pollutant Loadings

Wastewater and Industrial Discharges:

The following table is a list of NPDES Permitted Point Source Discharges to the Kawkawlin River Watershed.

Table XX: NPDES Point Source Discharge Permits in the Kawkawlin Watershed

NPDES Permit_no	Facility_Location_Name	Industry_type	Certificate_of_Coverage_Type	Receiving_Waters
MIS210504	3M Scientific Anglers	manufacturing facility	SW Industrial CY2 General Permit	Labonzinski Drain
MIG490270	Beaver Road Pit		Unknown	
MIS210805	Bennett Construction, Incorporated	Sand Mining	SW Industrial CY2 General Permit	unnamed trib. of Pashok Dr
MIG610187	Charter Township of Bangor	MS4	SW_Municipal	Kawkawlin River & Drains
MIS210808	DeShano Sand Mining	mining	SW Industrial CY2 General Permit	Kawkawlin River
MI0000329	Dow Corning Corporation	manufacturing facility	SW-Containment CY2 General Permit	Dell Creek
MIS220041	Dow Corning Corporation	manufacturing facility	Monitoring Requirements	Hoppler Creek
MIS210176	Eddy Brothers Auto Parts, Incorporated	automotive	SW from Industrial activity CY2	Unnamed Dr. (to Kawk. R.)
MIS210163	General Housing Corporation	Modular Homes Manufacturer	SW Industrial CY2 General Permit	Culver Creek
MIS210464	Holsinger Manufacturing Corporation	furniture manufacturer	SW Industrial CY2 General Permit	Kawkawlin River
MIS210562	Hooper Auto Sales	auto parts/salvage	SW Industrial CY2 General Permit	Kaiser Drain
MIS210755	Howe Auto Sales	auto parts/salvage	SW Industrial CY2 General Permit	Kawkawlin River
MI0027545	Huron and Eastern Railway Company	railroad	Monitoring Requirements	Kawkawlin River
MIG610188	Kawkawlin Township	MS4	SW-Municipal	Kawkawlin River & Drains
MIS210467	Metro Fabricating	metal fabricating	SW Industrial CY2 General Permit	Cole Drain
MIS210167	Michigan Department Military & Vet Affairs	MS4 (Nat'l Guard Armory)	SW from Industrial activity CY2	Larry Lake
MIG610189	Monitor Township	MS4	SW-Municipal	Kawkawlin River & Drains
MIS210526	Plyforms, Incorporated	manufacturing	SW Industrial CY2 General Permit	Culver Creek
MIS210645	Quantum Composites, Incorporated	manufacturing facility	SW Industrial CY2 General Permit	Wilcox Drain
MIS210465	R & W Auto Sales	automotive	SW Industrial CY2 General Permit	N. Br. Kawkawlin R.
MIS210629	Repair & Leasing Services	automotive ?	SW Industrial CY2 General Permit	Kawkawlin River
MIS210450	Terry's Auto Parts	automotive	SW Industrial CY2 General Permit	Unnamed trib to Millpond Dr.
MIS210175	Tri City Used Cars, Incorporated	automotive	SW Industrial CY2 General Permit	Unnamed trib to Kawk. R.
MIS210561	Unit Step	concrete	SW Industrial CY2 General Permit	Millpond Dr. Branch 2
MIG580079	White Birch Village Mobile Home Park	MS4	Unknown	
MIS210511	Wieland Sales, Incorporated	Retail	SW Industrial CY2 General Permit	Bradford Creek

The following table is a list of permitted point source discharges to the North Branch of the Kawkawlin River TMDL Watershed.

Table XX. NPDES Permitted Discharges for North Branch of the Kawkawlin

Facility	**Permit No.**	**County**	**Receiving Waters**
Individual Permit			
MDOT MS4	MI0057364	Statewide	----------
MIG580000 General Permit	**WWSL**		
White Birch Village MHP	MIG580079	Bay	Hembling Drain
MIS119000	**Storm Water From Industrial Activities**		
R & W Auto Sales	MIS210465	Bay	N. Br. Kawkawlin
MIG610000	**Municipal Separate Storm Sewer System (MS4)**		
Bay CDC MS4-Bay	MIG610195	Bay	County wide
Bay CRC MS4- Bay	MIG610196	Bay	County wide
Kawkawlin Twp MS4-Bay	MIG610188	Bay	Township wide
Monitor Twp MS4-Bay	MIG610189	Bay	Township wide

Designated and Desired Uses, Met, Impaired, or Threatened

Agriculture

The designated use of agriculture is considered to be met on the Kawkawlin River for the most part. However, the hydrology of the river does create flooding issues for bordering agricultural lands. At times some areas just north of the confluence of the North and South Branch experience excessive flooding and "wet" periods of time which delay the farmers ability to enter their fields to pursue their industry. Additionally, there are areas where the channel of the river has narrowed and affects farmers in one area by creating a situation where flooding is an annual event.

Industrial Water Supply

The use of the Kawkawlin as a source of water for industrial enterprises is not a designated use in this watershed. No industrial facilities draw water from the river or its branches.

Public Water Supply at the point of Intake

The Kawkawlin River is not a source of water for public use or as a point of intake for water for public use. However, there is a municipal water intake located to the south for the residents of Bay City and surrounding communities that purchase their municipal water from this treatment plant. The actual point of intake is Saginaw Bay, but the Kawkawlin contributes a sediment load to the greater bay that could have an effect on this water supply if the Kawkawlin River water quality and sediment load is not addressed.

Navigation

The designated use of navigation is impaired in the watershed. In the Main Branch the impediment is excessive aquatic plant growth with its subsequent issues. There is a significant amount of trash and floatables that must be addressed every year in an annual clean up effort by property owners along the river. In the upper reaches of the North and South Branch bank erosion undermines trees along the bank causing them to fall into the river creating hazards to navigation by canoes, kayaks and similar light watercraft. These woody debris can, at times, exacerbate sedimentation and erosion in the channel especially if the tree falls across the entire width of the channel. On the Main Branch there are areas of sedimentation that create problems for power boats. When the Saginaw Bay is at a low water level there are issues with navigation at the mouth of the Kawkawlin River as well. Overall, there are large amounts of sediment that are affecting the capacity of the river channel and the channel is in need of dredging and in some areas widening to assure better hydraulics of the channel. The South and North Branches have limited public access sites to the River, while the upper branches may not necessarily be suitable for motor boats to access, more access points for recreational watercraft such as canoes and kayaks would be beneficial. A green path for recreational boaters has been recommended. More public access sites and facilities are needed. A final hazard to navigation is old crossings from the oil fields in the lower portion of the watershed. It is understood these pipes are no longer being used and should be removed to lessen a navigation hazard but also a safety and potential pollution source.

Warmwater Fishery

The Warmwater fishery for the North Branch of the Kawkawlin has been addressed by a report issued by the DNRE in 2007 as being impaired. This was primarily because of a dissolved oxygen issue in the river. When looking at the South Branch there is also an issue of sedimentation that is creating problems for fish and the fishery of the South Branch. During the summer the dissolved oxygen in both branches get very low. The backwater effect of Saginaw Bay on the River also impedes the flow regime and creates a “stagnant” water situation that is not conducive to a good warm water fishery. However, there is a walleye rearing pond on the Kawkawlin and this fish species is making a comeback in the River. There have been reported fish kills on the river related to low oxygen levels. Additionally, the problems with sedimentation are eliminating a healthy

substrate for macro invertebrates that are an important food source for the warm water fish species that stakeholders in the watershed wish to promote.

Other Indigenous aquatic and wildlife

The native wildlife and aquatic life is impaired in the Kawkawlin Watershed. Along the South Branch the greatest impairment is the loss of habitat. But the most obvious impairment is wetland loss and fragmentation. Nutrients and pesticides are also impairing aquatic life and wildlife by killing off fish and associated food sources, promoting algae growth that can decimate oxygen levels in the water.

Total and Partial Body Contact Recreation between May 1 and October 31

Total and partial body contact recreation is impaired in the Kawkawlin Watershed. In the Main Branch in particular it is threatened by pathogens (E.coli) that can pose a threat to individuals who come into contact with the water when levels of pathogens are high. During 2009 there were no beach closings or advisories however the following table indicates closures from 2005 to 2008, noting there were historical closures before those years. This information is from the DNRE web site for the Kawkawlin River Boat Launch at the mouth of the river.

Table X. Contamination Advisories at Kawkawlin Boat Launch

Year	Dates	# Days Closed	Reason	Source
2008	8/20 to 9/24	35	High Bacteria levels	Unknown
2008	6/24 to 7/22	28	High Bacteria levels	Unknown
2007	8/23 to 8/29	6	High Bacteria levels	Unknown
2007	6/7 to 6/12	5	High Bacteria levels	Unknown
2006	8/29 to 8/31	2	High Bacteria levels	Unknown
2006	6/20 to 7/26	36	High Bacteria levels	Unknown
2005	6/29 to 8/2	34	High Bacteria levels	Unknown
2005	6/17 to 6/22	5	High Bacteria levels	Unknown
2005	6/10 to 6/13	3	High Bacteria levels	Unknown

The stakeholders group at a quarterly meeting determined their priorities and after discussions regarding the health of the watershed in various formats over the years the following table was developed to reflect the priority of designated uses for the Kawkawlin River.

Table XX. Prioritization of Designated Uses in the Watershed

Priority Level	Designated Use	Designated Use status	Suspected or Known Pollutant
1	Total and Partial body contact recreation	Impaired	*E.coli,* nutrients, sediment, pesticides, chemicals (brine, petroleum, etc).
2	Indigenous aquatic life and other wildlife	Impaired	Loss of habitat both terrestrial and aquatic, sediment, nutrients, low dissolved oxygen, pesticides
3	Warm water fishery	Impaired	Sediment, nutrients, low dissolved oxygen (N. & S. Branch), loss of habitat (S. Branch) water depth, loss of aquatic habitat
4	Navigation	Impaired	Sediment, water depth, trash, woody debris, pipe crossings, limited access sites, water depth
5	Agriculture	Meets	N/A
6	Public water supply	Not a use in this watershed	N/A
7	Industrial water supply	Not a use in this watershed	N/A

Desired Uses in the Kawkawlin River Watershed

Members of the Stakeholders Group discussed desired uses for the Watershed as improving warm water fisheries and conditions (habitat) for the river system. They wished to improve and protect habitat and conditions for aquatic life and wildlife along the river. This group of concerned stakeholders also wished to protect the quality natural features of the river corridor, and preserve the rural character (farmland and open spaces) of the watershed. The development of a sustainable plan for the Watershed and implementation of BMPs along with providing environmental education opportunities was among the goals for the overall watershed. The Saginaw Bay area has been the focus of many efforts to improve water quality. Reducing the amount of pollutants entering the

Great Lakes from a tributary such as the Kawkawlin River also meets the goals of the Great Lakes Restoration Initiative as presented in 2009. The development of this plan and the future work on the Kawkawlin River has and will involve the residents, business owners, local officials, and decision-makers in a hands-on effort to improve and protect their environment and local water resources. The Saginaw Bay is a recreational area, providing opportunities for boating, fishing, and hunting. The residents support these uses and desire the Watershed to maintain its environmental integrity in order to continue these uses. The preservation and enhancement of opportunities for human use of the watershed with minimal adverse impact was a definite goal for the stakeholders. They love their watershed and invest their time and energy in it. They want to learn how to better care for it and implement projects in the river that will have a beneficial long term affect on the quality of the river and its habitats. The Kawkawlin River watershed is within the eligibility sphere for Michigan's Conservation Reserve Enhancement Program. Participation in this program has provided funding to enhance wildlife habitats and encourages wildlife diversity. Also there has been voluntary participation in use of vegetated buffers along county drains and similar surface drainage systems by area farmers. They are concerned with the outcome of this overall plan and want more of their colleagues to become involved with prevention of sedimentation. The expected benefits to the continued improvements within the watershed will be a cleaner Kawkawlin River and Saginaw Bay. With improved water quality will come improvements in the wildlife community, recreational opportunities for the public, and improved business opportunities, and a reduction in health risk and less expenditure of scarce funds for remediation of polluted regional resources.

Critical Areas

The critical area is defined as “That part of the watershed that is contributing a majority of the pollutants and is having the most significant impacts on the waterbody.” In the case of the Kawkawlin and most other river systems it is the source of the greatest amounts of Non Point Source pollutants to the river. By prioritizing the 8 sub-watersheds this plan will define the boundaries for the implementation of BMPs to address issues in the subwatersheds which will have an effect on the overall watershed.

Identification of Critical Areas

Several different methods could be used for identification of critical areas, these were discussed in various committees that have been established. All committees looked at data gathered and looked at prioritizing the subwatersheds based on the aspect they were specializing in. For example the Corridor sub committee was involved in land use issues, and would prioritize based on those criteria. The Water Course sub committee would look at water quality issues as presented in data and make decisions based on their focused view of the watershed, as would the Nutrient/Pathogen sub committee. This plan will rank the priorities by sub watersheds.

The highest priority subwatersheds are located in the most intensively farmed portion of the Kawkawlin watershed and are impacted by overland sediment and nutrient pollution. The lowest ranking sub watershed, number 1, is located in the northern portion of the Kawkawlin watershed, which contains much more wetland and forest. The primary issue of concern in Sub watershed 1 appears to be livestock access and streambank erosion because of lighter soils.

The highest priority watershed is Sub Watershed #7 also known as Culver Creek. This area is predominately agricultural for land use. It historically had a large pre-settlement wetland area of 6,933 acres but has lost almost 94% of those wetlands. The upper reaches of the Culver Creek hold an extensive amount of sediment to the point of choking off field tile outlets. Ag fields in this region are primarily surface drained now, which exacerbates the sedimentation issues. This sediment loading is a nutrient source and an oxygen demand source that has attributed to low dissolved oxygen levels discharging into the Kawkawlin River. There is also a moderate amount of roadside culverts and crossings that are eroding and contributing to the sediment deposition. The cleaning out of the Culver Creek to remove nutrient loads and reinstate the function of the field tiles would be beneficial. This would also alleviate some of the surface drainage and decrease sediment loads.

In breaking it down to specific problem areas or topics we have the following:

Road/Stream Crossings
High Priority sites identified in subwatersheds 8, 3, and 7 and in Garfield Township subwatersheds:
Culver Creek (7), Bangor and Monitor Townships (3, 7), in sub-watershed 3 and 7 the primary crossings of concern are former petroleum pipelines. Pictures of these pipe crossings are located in Appendix XX. There needs to be an effort to have these removed to better navigate the river and prevent petroleum from leaking into the River.
Medium Priority sites identified in 5 other subwatersheds: Betzoid Drain (South Branch),

Trash and Debris
High Priority sites identified in Kawkawlin and Bangor Township subwatersheds: Main Branch
Low Priority remaining watersheds

Livestock Access and Potential Runoff
High Priority access site identified in subwatersheds 1 and 2.
Medium Priority subwatershed 7 and 4.
Low Priority for remaining subwatersheds

Rill and Gully Erosion

High Priority subwatersheds estimated from inventory and percentage of agricultural land use 7, 6, 5 and 2
Medium Priority subwatersheds: 4 and 3
Low Priority subwatersheds: 1 and 8

Streambank / Drain Bank Erosion
High Priority sites identified in subwatersheds 7, 6,
Medium Priority subwatersheds: 5, 2, 4 and 3
Low Priority subwatersheds: 1 and 8

Tile Outlets
High Priority sites identified in subwatershed 8, primarily in Bangor Charter Township, this area has completed and NPDES Illicit Discharge Elimination Plan. However it needs to be monitored over the next few years to assure it is not causing a problem during event storms.

Storm Water Runoff
High Priority sites were identified in subwatersheds with municipal storm sewer system outfalls in Bangor and Monitor Townships, they are: Mill Pond Drain and branches, Bangor Twp Relief Drain, Drouillard Drain, Frank Jean Drain, Burgeson and the Jean Aplin Drain

On Site Treatment (Septic) System Maintenance
High Priority is defined as a high number of septic systems per square mile are as follows: Sub-watershed 8 the mean age of the systems is 36 years per records found.
Medium Priority: Subwatershed 3 is also a priority in the few residential areas in proximity to the North Branch.
Low Priority subwatersheds include the remaining subwatersheds, it is assumed that systems in these areas are greater than 25 years old. The BCHD will need to further gather information to further expand its data base for the entire Kawkawlin watershed.

Manure Management
High Priority sites were identified in subwatersheds 7 and 2
Medium Priority sites were identified in subwatersheds 1, 6 and 4.
Low Priority sites were identified in the remaining subwatersheds.

Wetland Protection and Restoration

A portion of the Kawkawlin watershed was determined to be a critical area for wetland protection and restoration due to the high amount of wetlands already lost. The historical pre-settlement times (pre-European), there was over 71,968 acres of wetlands functioning in the watershed. As of 2005 data only 23,264 acres of wetland remain and with that some functional aspects of the wetlands has been lost. In a priority restoration objective the following sub watersheds are a **high priority**, Sub-watershed 7 (Culver Creek), Sub-watershed 2 (North Branch), Sub-watershed 5 (Betzoid Drainage District). A **medium priority** has been established for the upper portion of Sub-watershed 2 and lower portion

of Sub-watershed 1 (Kawkawlin Creek) should be protected and have restoration goals set for these two areas. Recommendations to continue to assess the watershed are discussed in further chapters. See the map for locations of High and Medium potential areas that should be concentrated upon for the future.